AERIAL IMAGING OF STRAWBERRY FIELDS USING DRONES TO ASSESS STING NEMATODE FIELD DISTRIBUTION, YIELD IMPACTS AND SOIL FUMIGANT PERFORMANCE.

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In Florida, the Sting nematode (*Belonolaimus longicaudatus*) is a very important yield limiting pest, infesting an estimated 40% of strawberry acreage. Yield losses and patchy field distributions of plant stunting are well correlated with soil population densities of the Sting nematode. For these studies, digital color imaging and end of season assessments of plant size were used to characterize the distribution and degrees of plant stunting, strawberry yield, and within row measures of green plant canopy cover. For relative yield determinations, the numbers of plants in four plant size categories were systematically recorded at 12 to 15 m intervals throughout the experimental areas within these fields. Plant size categories, measured as average canopy diameter, were dead (0), small (<20 cm), medium (>20 and < 30 cm) and large (>30 cm). Relative yields were cumulatively derived for each plant size category from percentage contributions of maximum yield potential determined from previous research. Aerial imaging surveys of four commercial field locations were conducted on 28 November 2017, 13 December 2017, 22 January 2018 and 15 March 2018 using a DJI™ Phantom 4 Pro UAS drone carrying a DJI camera equipped with a 24mm 20MP Exmor R CMOS sensor. Image orthomosaics were created using DroneDeploy™ cloud software platform with an image resolution of 10 to 20 mm per pixel. Processed RGB and NDVI maps were analyzed using ESRI™ ArcGIS v10.33. Within these maps, green pixel counts were used to provide estimates of green canopy cover (% greenness) against a backdrop of black plastic mulch covering the raised bed Strawberry canopy cover and relative yields derived from plant size assessments were compared using regression analysis and with commercial harvest yield information for some of the fields.

Percent greenness (vegetative cover) computed from green pixels within plant rows was always highly correlated with relative strawberry yield and of commercially harvested strawberry yields expressed as flats per acre, explaining 77% to 92% of the variation between any two of the different response parameters. Accurate maps and assessments of fumigant treatment performance, GPS location, and sting nematode stunting severity of strawberry plants was well described by digital imaging using the DJI drones for field mapping. These results illustrate how digital imaging and greenness analysis can be used to provide quantitative measures of strawberry yield and to provide growers guidance on suitable alternatives to methyl bromide soil fumigation for nematode management. In addition to quantifying end of season strawberry production impacts, drone assisted aerial mapping will also enable assessment of strawberry

transplant quality, disease incidence and severity, as well as to characterize end of season strawberry production impacts within disease impacted fields.